Encl #4
DPS-4319
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Proposal to Modify System 4 to Correct for Temperature Effects and to Eliminate Spurious Signals

August 22, 1958

CMCC Document No. 1133X5.69
Copy / of 12 Copies

(This documents contains a total of 5 sheets including this title sheet)

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1. General

a. During environmental testing performed on System 4 equipment, it has been observed that the sensitivities of the Band 1A and Band 1B receiving channels became appreciably degraded under conditions of extended periods of operation at high altitude. Some corrective measures have been incorporated within the limitations imposed by test and delivery schedules. However, Band 1 receiving equipment still suffers from the effects of the operating environment to a greater extent than the other receivers in the system. Redesign as described herein is proposed to correct this difficulty.

b. It is difficult to eliminate completely the spurious signals originating in the second local oscillators of both Band 1A and Band 1B receiving channels. If false locks with the accompanying dead time and waste of film are to be avoided, the lock-on circuits must be disabled at certain points in the scan cycle. This results in the loss of some of the potential frequency coverage. Repackaging of the first i-f assemblies in both Band 1A and Band 1B receiving channels as described herein is proposed as the most effective and reliable means for eliminating the spurious signal effects.

2. Proposed Redesign to Correct for Temperature Effects

a. High temperatures are developed in the Band 1 receiving equipment when operated at high altitude. This causes the following undesirable changes in the electrical characteristics of several important circuits of each receiving channel:

(1) The frequency of the second local oscillator drifts.

(2) The center frequency of the first i-f amplifier drifts.

(3) The gain of the first i-f amplifier decreases.

(4) The gain of the second i-f amplifier decreases.

(5) The crossover frequency of the AFC discriminator drifts.

b. Some corrective measures taken, with partial success, have included:

(1) Replacing a temperature-sensitive tuning inductor in each second-local-oscillator circuit with a more suitable type.

(2) Increasing the first i-f amplifier bandwidth of each channel, thus reducing the effect of the remaining second-local-oscillator frequency drift on sensitivity.

(3) Eliminating a buffer-amplifier tube for each second local oscillator, thus reducing the heat dissipated in this location.

(4) Incorporating in the equipment an additional fan for cooling the respective assemblies containing the first i-f amplifier and second local oscillator of each channel.

c. It is proposed to redesign the first i-f and second i-f assemblies of each of the receiving channels as follows:

(1) All frequency-determining components will be chosen for improved temperature stability. In cases where the variable inductors now used do not have the required stability, suitable variable capacitors, such as the piston type with glass or quartz dielectric, will be used.

(2) The double-tuned transformers used in the second i-f amplifier will be redesigned for improved temperature stability.

3. Proposed Redesign to Eliminate Spurious Signals

a. Harmonics of the second-local-oscillator frequency are picked up in the first mixer and cause the respective receiving channel to lock at several points in its scan cycle. Various corrective measures have been attempted, such as additional decoupling and shielding, with some results in spurious-signal reduction. However, in order to reduce such effects reliably and consistently below the threshold level, much better shielding is needed for the circuits associated with the oscillator.

b. In order to present spurious signals originating in each second local oscillator from interfering with the operation of the respective receiving channel, it is proposed to repackage each of the first i-f assemblies. Better shielding will be provided for the circuits associated with the second local oscillator. Additional shielding will also be incorporated to prevent oscillator energy from traveling inside the amplifier from output to input.

c. Both the second mixer and second local oscillator will be located in a shielded compartment. Where possible electrically, connections will be brought into this compartment via feedthrough-type bypass capacitors. The output stage of the first i-f amplifier will be located close to the shielded compartment, so that ground current returning to the oscillator travel the shortest possible path.

d. All tubes will be mounted inside the first i-f assembly, since experience with the present amplifier design indicates that the externally mounted tubes cause conditions highly conducive to osciallator leakage. It is proposed to include spring fingers in the amplifier cover to contact the tube shields, thus dividing the amplifier into a series of compartments and minimizing waveguide coupling of oscillator energy from output to input.

e. Cooling fins on the back of each amplifier will receive forced air from the additional fan which has already been provided.